# Managing interteam coordination within and between organizations

de Vries, Thomas Arend

# CHAPTER 3

# MANAGING COORDINATION IN MULTITEAM SYSTEMS: INTEGRATING MICRO AND MACRO PERSPECTIVES[5]

## Abstract

Multiteam systems (i.e., teams of teams) are frequently used to deal with complex and demanding challenges that require several teams' joint efforts. Yet, achieving effective horizontal coordination between such systems' lower-level component teams remains notoriously difficult. Using insights from organizational behavior research, we argue that horizontal coordination between component teams can benefit if a multiteam system is composed of generalist members acquainted with the multiple functions present in the overall system (i.e., high intrapersonal functional diversity; IFD). At the same time, however, such IFD may have detrimental side-effects, because generalists' broad focus may distract them from high-impact, specialized activities (i.e., aspirational behavior). Building on insights from organization theory, we propose that coordination across a multiteam system's hierarchical layers (i.e., vertical coordinated action between a higher-level integration team and lower-level component teams) is critical for reaping IFD's benefits while avoiding its costs. These notions were supported in a sample of 236 fourteen-person multiteam systems engaged in a realistic decision-making simulation. Our findings illustrate how combining insights from organizational behavior and organization theory can advance academic knowledge on multiteam systems and offer practical solutions for managing coordination and performance within such systems.

---

[5] This chapter is based on de Vries, T.A., Hollenbeck, J.R., Davison, R.B, Walter, F., & van der Vegt, G.S. (In press). Managing coordination within multiteam systems: Integrating micro and macro perspectives. ***Academy of Management Journal***.

Many critical tasks in business and society are beyond the capacity of single individuals or even single teams (DeChurch & Zaccaro, 2010). For example, large-scale transportation networks, military operations (Goodwin, Essens, & Smith, 2012), emergency responses (DeChurch & Mathieu, 2009), and new product developments (Hoegl et al., 2004) typically require coordinated actions of two or more teams, each with distinct areas of expertise (Mathieu et al., 2001). These "multiteam systems" (MTSs) bring together "a complex variety of skills, knowledge, and functions" in adaptive structures that are especially suited to managing highly complex task environments (Zaccaro et al., 2012: 12). They comprise a greater number of members and are structurally more complex than stand-alone teams (with distinct component teams as an additional layer), but they are smaller, more agile, and less bureaucratic than traditional multi-unit organizations (e.g., corporate divisions; Davison et al., 2012).

In order to function effectively, MTSs need to combine the efforts of the component teams responsible for operational task execution (Ford & Schmidt, 2000; Mathieu et al., 2001; Zaccaro et al., 2012). Such *horizontal coordination* represents the extent to which component teams from the same hierarchical level align and synchronize their activities with each other (Lanaj et al., 2013; Marks et al., 2005). Effective horizontal coordination enables MTSs to synthesize component teams' distinct contributions and utilize these teams' complete range of specialized resources (DeChurch & Mathieu, 2009; Marrone, 2010; Smith, Carroll, & Ashford, 1995). Regrettably, however, horizontal coordination is often difficult to achieve due to MTSs' sheer size (Browning, 1998; Davison et al., 2012), and due to misunderstandings that can arise from differences in component teams' languages, routines, and thought-worlds (Zaccaro et al., 2012). Indeed, it appears notoriously difficult to effectively manage MTSs, and many of the documented performance breakdowns within such systems have been attributed to ineffective horizontal coordination (DeChurch & Zaccaro, 2010). Prime examples include the delayed emergency response following hurricane Katrina in 2005 (DeChurch & Mathieu, 2009) and the loss of the Mars climate orbiter in 1999 (Postrel, 2002).

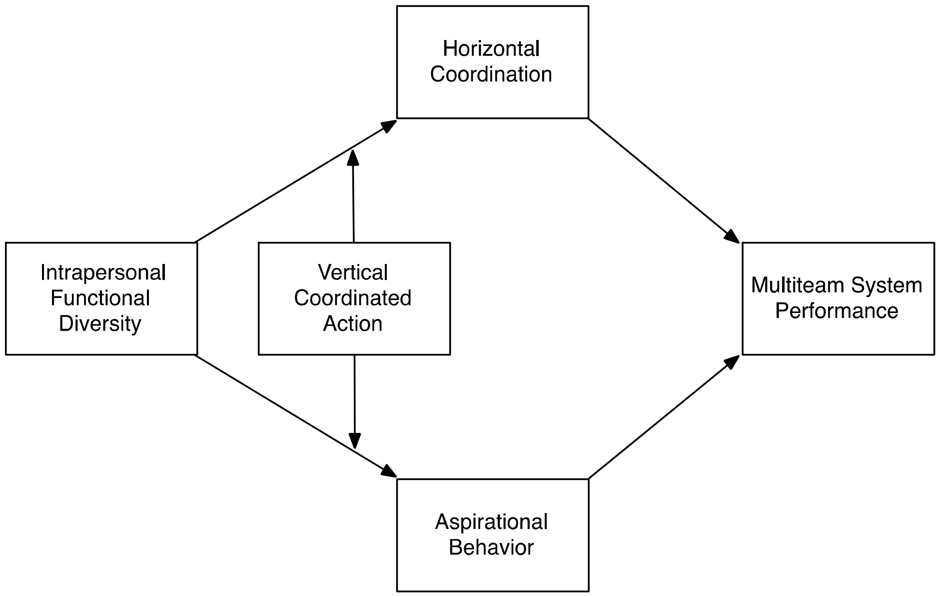
Two distinct research perspectives have generated insights on how to promote horizontal coordination. The dominant line of reasoning, in this respect, derives from a micro-level organizational behavior (OB) tradition. It focuses on providing teams with the capacity for realizing horizontal coordination in a bottom-up manner (Crichton & Flin, 2004; Ford & Schmidt, 2000). An important strategy that has emerged from this line of inquiry is to compose or develop teams with broad functional generalists instead of narrow specialists (Joshi, Pandey, & Han, 2009; Park, Lim, & Birnbaum-More, 2009). Studies in stand-alone, cross-functional teams, for example, have shown that *intrapersonal functional diversity* (IFD), defined as team members' average breadth of functional experience (Bunderson & Sutcliffe, 2002), improves members' collective understanding of each other's specialized contexts and constraints (Cannella, Park, & Lee, 2008; Park et al., 2009). Similarly, research on cross-training suggests that rotation through functionally distinct positions broadens members' knowledge of shared tasks, equipment, and functions (Cannon-Bowers, Salas, Blickensderfer, & Bowers, 1998; Marks, Sabella, Burke, & Zaccaro, 2002). Building on this logic, high IFD seems likely to facilitate horizontal coordination between component teams and promote MTS performance (Ford & Schmidt, 2000).

There is an important caveat to this conclusion, however, in that empirical research relating IFD to MTS performance is lacking. Also, research in related areas has not been able to consistently establish IFD's benefits for larger organizational units with multiple (sub)groups (Leenders & Wierenga, 2002; Maltz & Kohli, 2000). In fact, increasing IFD may have the unintended side-effect of limiting the depth of members' functional experiences and task focus (Hatvany & Pucik, 1981; Raskas & Hambrick, 1992). Steps taken to develop broad functional experience may hinder members' specialization (Cannella et al., 2008; Tesluk & Jacobs, 1998), in particular, because time, talent, and training budgets are all limited resources. This may pose important problems for multiteam systems, as members lacking deep, comprehensive experience in a specific work area have a tendency to avoid rather than proactively solve hard problems associated with the respective area (Postrel, 2002; Jans & Frazer-Jans, 2004). Thus, IFD's potential benefits for horizontal coordination may come at the cost of decreased aspirational behavior (i.e., a multiteam system's engagement in complex, specialized activities that push performance boundaries; Lanaj et al., 2013).

Importantly, a second, independent research perspective may reconcile these countervailing effects of IFD. Grounded in macro-level organization theory (OT; e.g., Galbraith, 1994; Lawrence & Lorsch, 1967), this perspective focuses on formal, top-down integration mechanisms that can promote MTS performance (Browning, 1998; Davison et al., 2012). Research in this tradition has found, in particular, that a central group of formal boundary spanners with system-wide leadership responsibility (i.e., an integration team) can support component teams through *vertical coordinated action* (i.e., "coordination that takes place between report-to and direct reporting actors across organizational levels whose breadth of scope and authority differ;" Davison et al., 2012, p. 809). Specifically, vertical coordinated action enables the integration team to transfer its big-picture information on system-wide task demands toward component teams (Davison et al., 2012; Galbraith, 1994) and, as such, may strengthen IFD's positive consequences for horizontal coordination and neutralize IFD's negative implications for aspirational behavior (see Figure 3.1).

**FIGURE 3.1**

**Conceptual Model**




We examined these notions in a sample of 236 MTSs comprising 3,304 individuals engaged in a series of realistic computer simulations while attending a leadership development program with tangible career consequences. This setting enabled us to overcome the "onerous research obstacles" (Gulati, 1998: 306) that have limited past empirical research in this area (e.g., compiling a sufficiently large number of comparable MTSs; DeChurch & Zaccaro, 2010).

Taken together, this research aims to contribute to our understanding of the antecedents of MTSs' horizontal coordination and performance. We illustrate how combining insights from micro-level OB and macro-level OT literatures enables important theoretical advances in MTS research (DeChurch & Zaccaro, 2010; Zaccaro et al., 2012) and, more generally, in research on collaborative task accomplishment (Marrone, 2010; Smith et al., 1995). Moreover, this study is important for management practice because it points to proximal variables (IFD and vertical coordinated action) organizations can manipulate through readily available interventions, enabling managers in multiteam contexts to shape critical, yet notoriously difficult-to-influence processes and outcomes (horizontal coordination and MTS performance).

## THEORY AND HYPOTHESES

### IFD as an MTS Property

Consistent with previous team-level research (e.g., Bunderson & Sutcliffe, 2002), we conceptualize IFD as a configural unit property (Kozlowski & Klein, 2000), representing the degree to which an MTS is composed of broad generalists with experiences dispersed across the system's multiple functional domains, as opposed to narrow specialists with experiences focused in a single domain. Unlike *inter*personal functional diversity, which reflects differences *between* members with regard to the functional domains in which they have obtained most of their work experience, *intra*personal functional diversity considers differentiation *within* individuals. As such, IFD captures the full spectrum and distribution of members' work experiences (Burke & Steensma, 1998; Joshi et al., 2009). IFD is highest when every MTS member has experience in all functional domains relevant to the system and lowest when every member's task-related experience is focused in a single domain. An MTS's IFD can be increased, for example, through inter-functional rotations, team member exchanges (Leenders & Wierenga, 2002), and cross-training (i.e., providing members with training in different functional domains; Marks et al., 2002).

### IFD and MTS Performance

***Promoting horizontal coordination: IFD's potential benefits.*** Research originating from a micro-level OB tradition has put forward theoretical and empirical arguments to support IFD's value for MTSs. Scholars have noted, for example, that broad functional backgrounds enable members to sense "the web of relationships" (Raskas & Hambrick, 1992: 10) that connects their activities within the overall system and to understand other system parts' functioning (Ford & Schmidt, 2000; Joshi et al., 2009; Kusunoki & Numagami, 1998). Hence, mutual knowledge regarding roles, tasks, and responsibilities may emerge within an MTS with high IFD (Cannon-Bowers et al., 1998; Ellis & Pearsall, 2011; Marks et al., 2002). This mutual knowledge reduces component teams' need to clarify task-related issues to each other, enabling them to implicitly coordinate efforts (Entin & Serfaty, 1999; Kotha, George, & Srikanth, 2013). When no or only a few MTS members possess broad functional experiences, in contrast, members need to engage in cumbersome interactions with partners from other component teams because they (or the respective partners) will find it difficult to consider each other's specialized requirements (Cramton, 2001; Kotha et al., 2013; Srikanth & Puranam, 2011). Taken together, this argumentation suggests that higher IFD may enhance mutual knowledge within an MTS, which represents an essential "tacit coordination mechanism" (Srikanth & Puranam, 2011: 855; see also Puranam, Raveendran, & Knudsen, 2012) that can provide component teams with the potential to realize horizontal coordination in an efficient, bottom-up manner.

Horizontal coordination may, in turn, promote MTS performance because it prevents redundancies and inconsistencies between different component teams' activities (Hoegl et al., 2004; Lanaj et al., 2013; Marrone, 2010). As such, horizontal coordination is generally regarded as fundamental for efficiently and effectively realizing collective outcomes (DeChurch & Mathieu, 2009; Mathieu et al., 2001). Research on rail-control MTSs, for example, has shown horizontal coordination to allow component teams from various carriers, network operators, and contractors to combine their expertise and, thus, to effectively solve joint operational problems (Goodwin et al., 2012). In addition, component teams may receive crucial support from other teams through horizontal coordination, enabling them to better execute key tasks for the system as a whole (Joshi et al., 2009; Marrone, 2010).

Importantly, however, IFD's value for horizontal coordination and MTS performance is not as clear-cut as the above argumentation might suggest. Despite the well-documented importance of IFD within stand-alone teams (e.g., Bunderson & Sutcliffe, 2002; Park et al., 2009; Rulke & Galaskiewicz, 2000), for example, IFD's consequences for more complex MTSs have not been studied. Moreover, empirical research in larger organizational units paints an inconsistent picture of IFD's value. Parry and Song (1993), for instance, found that multifunctional members strengthened integration between organizational units, while Leenders and Wierenga (2002) found that moving personnel across different functional departments did not aid such integration (see also Maltz & Kohli, 2000). Hence, it is unclear if the positive relation between IFD and horizontal coordination (and, ultimately, performance) observed in stand-alone teams will translate towards MTSs.

***Diminishing aspirational behavior: IFD's potential downsides.*** Besides IFD's potential (albeit ambiguous) benefits for horizontal coordination, it is important to note that IFD might, at the same time, go along with the undesirable side-effect of constraining an MTS's aspirational behavior, as reflected in a system's engagement in complex, specialist activities that are instrumental to the realization of its key strategic goals (Lanaj et al., 2013). A primary reason for these adverse effects is that frequent functional rotations leave members with little time to develop specialist knowledge within any particular work domain (Buyl, Boone, Hendriks, & Matthyssens, 2011). Without such sophisticated specialist knowledge, members may be tempted to forgo complex domain-specific activities in the MTS (Postrel, 2002: 360), adopt "tactical modes of professional behavior", and concentrate on simpler courses of action (Jans & Frazer-Jans, 2004: 258). Thus, aspirational behavior at the MTS level may suffer because of high IFD.

Neglecting these adverse side effects may have far-reaching ramifications, as aspirational behavior is fundamental for MTS performance (Lanaj et al., 2013). To return to the example of a rail-control MTS, it is a strategic goal of such systems to recover as quickly and robustly as possible from network disturbances. Accomplishing this challenging goal requires that an MTS goes beyond the mere treatment of surface-level symptoms to identify and correct the root causes underlying a disturbance (Jans & Frazer-Jans, 2004; Postrel, 2002). Lower levels of aspirational behavior may suffice to ameliorate a disturbance's direct consequences, but they are unlikely to effectively address long-term ramifications for the rail network as a whole. In fact, low aspirational behavior may even hurt performance, in the long-run, because this approach typically "doubles the [subsequent] repair effort and associated costs" (Goodwin et al., 2012: 60). In line with this argument, previous research at the team level of analysis has found that members who work toward more difficult and aspiring goals can realize more advanced contributions and substantial outcomes for their team (Knight, Durham, & Locke, 2001). Initial empirical work at the MTS level mirrors these findings, suggesting a positive relationship between aspirational behavior and MTS performance (Lanaj et al., 2013).

**Triggering Alternative Pathways: The Role of Vertical Coordinated Action**

Interestingly, a different research paradigm – originating from an OT tradition – may help to clarify IFD's countervailing effects in MTSs. The OB perspective discussed before examines how compositional characteristics shape horizontal coordination in an emergent, bottom-up manner. In contrast, the OT perspective focuses on formal, top-down integration mechanisms (e.g., Brown, 1999; Galbraith, 1994; Lawrence & Lorsch, 1967). This latter perspective has identified integration teams, in particular, as crucial for MTSs (Browning, 1998; Davison et al., 2012). Integration teams are a formal part of an MTS's structure; they are responsible for ensuring lateral coordination between lower-level component teams and realization of the overall system's strategic aims (Davison et al., 2012; DeChurch & Marks, 2006). For these purposes, integration teams typically hold a central leadership position, with members dedicated to spanning boundaries between component teams (DeChurch & Marks, 2006; Goodwin et al., 2012). This unique role allows integration teams to develop “big-picture information” on real-time coordination and strategic demands in the wider MTS (Davison et al., 2012: 812).

It is important to note, however, that higher-level integration teams typically cannot substitute for lower-level component teams’ efforts and single-handedly realize important MTS processes (Brown, 1999; Galbraith, 1994). Specifically, integration teams are likely to lack the time, manpower, and specialized expertise for directly translating their big-picture information into detailed component team actions (Davison et al., 2012; Nidumolu, 1995). Hence, integration teams’ key task is to support component teams’ bottom-up realization of horizontal coordination and aspirational behavior (Galbraith, 1994). To effectively realize this task, it is crucial that an integration team actively coordinates with component teams – an internal MTS process we label *vertical coordinated action* (Davison et al., 2012; Nidumolu, 1995). Such vertical coordinated action allows the integration team to transmit its unique perspective on system-wide coordination and strategic demands (Brown, 1999; Klein & Pierce, 2001), enabling component teams to act on such information (e.g., through horizontal coordination and aspirational behavior). Clearly, however, these potential benefits hinge on whether component teams can put the integration team’s support into effective use – and we propose IFD plays a key role in this regard.

As such, we maintain that OB and OT perspectives complement each other in important ways to enable a better, more comprehensive picture of MTS functioning. OB research provides a useful starting point for understanding how component teams’ capacities – as derived from IFD – may shape MTS processes, but does not speak to the role of the organizational structure in which such bottom-up processes take place (House, Rousseau, & Thomas-Hunt, 1995). Macro-level OT research, on the other hand, considers the role of top-down organizational context factors by focusing on formal integration teams, but generally ignores crucial bottom-up initiatives that can implicitly organize joint efforts (Browning, 1998; Davison et al., 2012; House et al., 1995; for a recent exception, see Srikanth & Puranam, 2011). Consequently, we follow recent theoretical developments (e.g., Kotha et al., 2013; Srikanth & Puranam, 2011; see also Gioia & Pitre, 1990) by adopting a multi-paradigm approach that integrates insights from the OB and OT literatures to study MTS functioning. We suggest that IFD and vertical coordinated action are intertwined in a complex manner, with vertical coordinated action determining whether IFD's advantages (increased horizontal coordination) or disadvantages (decreased aspirational behavior) will prevail (see Figure 3.1).

***The role of vertical coordinated action in the relationship between IFD and horizontal coordination.*** If IFD is to effectively stimulate horizontal coordination within an MTS, it is crucial that members have a thorough overview of activities and coordination demands within the system as a whole (Espinosa, Slaughter, Kraut, & Herbsleb, 2007; Klein & Pierce, 2001). Equipped with this overview, members can draw from their IFD and implicitly coordinate their own component team's activities with ongoing developments in other teams (DeChurch & Marks, 2006). Unfortunately, MTSs' large-scale and dynamic nature often prevents lower-level members from keeping informed about all activities and coordination requirements in the system (Browning, 1998; Davison et al., 2012). Integration teams are likely to play a critical role in addressing this issue, because their central location in the flow of work uniquely positions them to gain real-time, big-picture information on the overall system (Brown, 1999; DeChurch & Marks, 2006; Galbraith, 1994) and to transfer such information to component teams through vertical coordinated action.

Thus, we anticipate that higher vertical coordinated action will strengthen the positive relationship between IFD and horizontal coordination. MTSs with high IFD have the mutual knowledge necessary to enact implicit horizontal coordination (Cramton, 2001), and they receive crucial information from the integration team for employing this knowledge when vertical coordinated action is high (DeChurch & Marks, 2006). MTSs low in IFD, on the other hand, may be unable to enact effective horizontal coordination even when the integration team exhibits strong vertical coordinated action. In such circumstances, the system lacks mutual knowledge and experiences difficulties in sensing relationships between different teams' activities and implicitly structuring efforts that align component teams' divergent demands (Ford & Schmidt, 2000; Kusunoki & Numagami, 1998; Srikanth & Puranam, 2011). Hence, despite the integration team's efforts, horizontal coordination is likely to remain limited by misunderstandings between component teams.

In contrast, IFD is less likely to positively relate with horizontal coordination in MTSs with lower vertical coordinated action. In this situation, the integration team fails to provide support to guide horizontal coordination (Mathieu et al., 2001). With low IFD, it is clear, then, that horizontal coordination is unlikely to occur, as component teams lack mutual knowledge to implicitly take into account each other's demands (Ford & Schmidt, 2000; Joshi et al., 2009), and as the integration team provides little information to facilitate such efforts (Davison et al., 2012; DeChurch & Marks, 2006). Thus, the difficulties of aligning actions across component teams may overburden members' limited capacities (Faraj & Yan, 2009; Marrone, 2010). Importantly, however, even MTSs with functionally broad members (high IFD) are unlikely to effectively use their mutual knowledge for horizontal coordination when vertical coordinated action is lacking. In this situation, component teams have to uncover coordination requirements through cumbersome interactions, before they can implicitly align their efforts (Browning, 1998; Davison et al., 2012). Hence, much of IFD's potential is likely to be spent on preparatory actions when adequate integration team support is missing, rather than on horizontal coordination itself.

Taken together, we predict vertical coordinated action will allow MTSs to more effectively utilize their IFD for horizontal coordination, thereby strengthening IFD's performance benefits. With little vertical coordinated action, by contrast, these performance benefits should remain limited, as the positive relationship between IFD and horizontal coordination is less likely to materialize.

*Hypothesis 3.1: Vertical coordinated action moderates the indirect relationship between IFD and MTS performance, as mediated by horizontal coordination. This positive indirect relationship is accentuated when vertical coordinated action is higher and attenuated when vertical coordinated action is lower.*

***The role of vertical coordinated action in the relationship between IFD and aspirational behavior.*** Besides the coordination advantages described earlier, integration teams' central role within MTSs should enable them to obtain big-picture information on the system's realization of its strategic goals (DeChurch & Marks, 2006; Galbraith, 1994; Klein & Pierce, 2001), and to transfer information on strategic demands towards component teams through vertical coordinated action. In MTSs with high IFD, vertical coordinated action may therefore compensate for component team members' pragmatic orientation towards immediate and obvious tasks and away from high-impact, yet difficult activities (Jans & Frazer-Jans, 2004). Under such conditions, the integration team can emphasize core strategic directions for the system as a whole and focus component teams' efforts on challenging, specialized activities that advance such goals (Brown, 1999; Mathieu et al., 2001). Even MTSs with high IFD are likely, then, to retain a focus on aspirational goals and activities during specialized task execution, diminishing the negative relationship between IFD and aspirational behavior.

In contrast, this negative relationship should surface particularly strongly when vertical coordinated action is less pronounced. In this situation, the integration team fails to disseminate strategic directions and to guide the system towards high-impact, challenging goals (Browning, 1998; Klein & Pierce, 2001). MTSs comprising functionally narrow specialists (low IFD) may be able to exhibit aspirational behavior to some degree even in this context, because members have thorough domain-specific knowledge that allows them to identify and execute complex tasks related to their specialized work domain (Postrel, 2002). In MTSs with high IFD, however, generalists' broad and relatively superficial perspective on specialized tasks may focus them on immediate, obvious, and low-impact tasks, and a lack of vertical coordinated action is likely to exacerbate this orientation. After all, the integration team does little to redirect functionally broad members' focus towards strategic, high-impact goals in this situation, sustaining the overall system's narrow functional outlook.

Taken together, we predict that strong vertical coordinated action can compensate for IFD's negative performance effects by diminishing the inverse association between IFD and aspirational behavior. With low vertical coordinated action, however, increasing IFD is likely to go along with substantial decrements in aspirational behavior and, thus, to deteriorate an MTS's performance outcomes.

*Hypothesis 3.2: Vertical coordinated action moderates the indirect relationship between IFD and MTS performance, as mediated by aspirational behavior. This negative indirect relationship is accentuated when vertical coordinated action is lower and attenuated when vertical coordinated action is higher.*

## METHODS

### Research Design and Sample

This study employed a "situated experiment" (Greenberg & Tomlinson, 2004: 703) to leverage benefits of both laboratory (e.g., control, standardization) and field research (e.g., realistic sample, tasks attached to tangible consequences). Our sample comprised 3,304 United

States Air Force officers attending a five-week leadership development course. Participants represented a broad range of job categories and had between five and nine years of professional experience. For the present study, these participants dealt with tasks highly similar to their regular jobs, and their performance in the study tasks was part of their overall course evaluations and influenced future advancement and promotion opportunities.

As part of the course, participants were assigned to 236 fourteen-person MTSs that worked together on a series of realistic computer-based decision-making simulations (i.e., the Leadership Development Simulation; LDS). Each system participated in three independent LDS sessions (with equivalent procedures and identical membership) during the course of the leadership development program. Data for the present investigation is mainly based on the third and final simulation session. Participants' assignment into a specific MTS was designated by Air Force trainers to ensure competitive fairness and equivalent composition (e.g., in terms of age, gender, occupational category, etc.). Also, task difficulty and complexity was held constant by using the exact same configuration of the simulation across all 236 MTSs. All participants received comprehensive training prior to their first LDS session, including reading material, an illustrated training presentation, and three hands-on practice rounds. Moreover, MTSs were given a limited intelligence briefing, and they could use 10 minutes before the start of a simulation session for initial planning and goal setting. MTSs then participated in computer-based simulations lasting roughly 120 minutes per session.

The 236 MTSs in the present sample were part of a larger research program designed to comprehensively advance scientific knowledge on MTSs. We were unable to control or manipulate IFD in this context (e.g., through random assignment to different IFD conditions), because simulation results had tangible implications for participants' career advancement. Hence, we used a-priori screening criteria to select comparable MTSs from the overall research program that had similar opportunities to develop and apply IFD (for similar approaches, see Holloway & Parmigiani, 2015; Reuer & Devarakonda, 2015; Schulze, Lubatkin, & Dino, 2003). Specifically, we included all MTSs that had remained (a) intact across all three LDS sessions (i.e., no membership additions or losses during any LDS session), and (b) stable after developing different levels of IFD across the first and second LDS sessions (i.e., no changes in members' functional roles between the second and third sessions). These criteria build on the notion that (a) IFD and performance in the third and final session are only comparable between MTSs with constant membership throughout all sessions, and (b) IFD's implications could fully surface in the final session only in MTSs that had finished developing IFD after the second session.

As is common in large-scale research efforts (e.g., Huxham & Vangen, 2000), the overall research program was designed to produce several studies on different aspects of MTS functioning. Consequently, some of the MTSs in the present sample had also been used in prior studies (Davison et al., 2012; Firth, Hollenbeck, Miles, Ilgen, & Barnes, 2014; Lanaj et al., 2013).[6] Importantly, however, the data from the third LDS session used here have not been previously examined, and no other study in this program has examined IFD. The present study is thus unique both empirically and conceptually. Also, we note that our results are robust when controlling for key variables included in previous studies.

**MTS Simulation**

***Task.*** The LDS is a computer-based simulation during which all 14 participants within an MTS were collocated and free to communicate with each other. This simulation created a complex and dynamic task environment that required MTS members to work interdependently and under time pressure to deploy a large number of assets (i.e., remotely piloted aircraft [RPAs]

[6] A detailed description of overlap between studies' samples is available upon request.

and intelligence assets) to achieve a common goal (i.e., maximizing the system's overall point score). Points were gained by successfully engaging a variety of targets hidden on a 256-cell task environment, and points were lost when RPAs or their home base were attacked.

Targets' point value varied by size and class, with large "opportunities" carrying the highest and small "threats" carrying the lowest value. Threats (but not opportunities) had the ability to attack RPAs and the home base. To increase environmental uncertainty and problem-solving workload, target types were initially disguised for half of the targets in the third session. Participants therefore had to collaboratively engage in a process of exploration, experiential learning, and reasoning to discover these targets' attributes. Initial target placements as well as target types and movements were identical for all MTSs.

***MTS composition and roles.*** MTSs contained three types of teams; a point team and a support team (as component teams) as well as an integration team. The point team's primary role was to engage targets, whereas the support team's role was to provide accurate intelligence on target location and identity. Each of these two component teams comprised four staff members with specific responsibilities as well as two boundary spanners (denoted director and assistant director). The individual point team staff members controlled one category of identical RPAs with unique capabilities each (i.e., engaging opportunities, neutralizing threats, providing information on targets' identity, and refueling other RPAs for long-distance missions). Moreover, each of the four support team staff members controlled one unique category of intelligence assets with distinct "sweet spots" (i.e., the zone in the simulation environment in which the respective asset provided reliable information on targets' identity). Intelligence assets' sweet spots were unknown at the start of the simulation and thus, participants had to uncover these zones through collective exploration and shared learning.

Additionally, MTSs included an integration team that comprised the four boundary spanners from the component teams and two additional members (denoted mission commander and vice commander). This integration team was tasked with a boundary-spanning role to facilitate cooperation between the component teams. Scholars have noted that enactment of this role can vary along a continuum from 'liaison' to 'integrative leadership', where liaison roles employ non-hierarchical means (e.g., information collection and dissemination), and integrative leadership roles rely on formal decision authority (Galbraith, 1994; Sherman & Keller, 2011; Sinha & Van de Ven, 2005). In the present case, one half of the integration team (the vice commander and assistant directors) enacted liaison roles without formal authority, whereas the other half (the mission commander and the two directors) had formal integrative leadership roles.

***Simulation set-up.*** Participants were presented with a blank grid representing the task environment at the start of a simulation. Hidden throughout the grid were threat and opportunity targets that varied along the aforementioned attributes. As previously discussed, threats that attacked RPAs and the home base resulted in point losses, and points could be earned when neutralizing threats. Opportunities similarly earned points for the MTS when engaged successfully, but they posed no threat of attack. To illustrate the simulations' complexity, we note that different RPAs were needed to engage different types of targets, and successful neutralization of some targets required simultaneous attacks through multiple RPAs. Also, some targets remained in the same location through the entire simulation, whereas others moved around the simulation grid, and any location in the task environment could be void of targets or could contain one or two targets.

A complete LDS session consisted of ten decision-making rounds. In each round, component team members first recommended specific asset deployments to their director; directors then reviewed these recommendations, made alterations if deemed appropriate, and passed the revised set of recommendations on to the mission commander for his or her review, potential further alteration, and final approval. An MTS's assets were then deployed and interacted with the simulation environment according to this final set of decisions. Collectively, the deployment process required 144 decisions in each round within a limited amount of time. Component team members received feedback on the interactions of their assets with the task environment after each deployment round and, afterwards, they had a limited amount of time to analyze this feedback and plan deployments for subsequent rounds. Successfully engaged targets were removed from the task environment, whereas destroyed RPAs were replaced at the start of the next round. All in all, effective performance required an MTS to collectively manage a large number of RPAs and intelligence assets under time pressure in order to successfully pursue different types of opportunities and neutralize diverse threats.

***Information management.*** Each MTS made use of an information exchange system called the Common Operating Picture (COP) – a digital map of the task environment that provided a means of sharing information regarding encountered targets' type and location. Component teams could use the COP to record information on self-identified targets for their own future reference, thereby enabling them to better realize their unique responsibilities. In addition, component teams could employ the COP for collective task achievement. The support team, for example, could draw on the COP to provide the point team with intelligence about potential targets, whereas the point team could utilize the COP to give feedback on the accuracy of such intelligence. Based on this information, component teams could then develop subsequent asset deployments. Importantly, however, such use of the COP was not obligatory; the point team was free to rely exclusively on knowledge gathered by its own assets, and the support team could rely solely on the formal feedback provided in the LDS. Also, given its retrospective nature, the COP did not convey any information concerning component teams' planned asset deployments.

The integration team's liaison members (i.e., the vice-commander and assistant directors) facilitated component teams' use of the COP by updating relevant information when new targets had been encountered and/or known targets had been destroyed. In doing so, these members did not have direct access to all information needed to update the COP and, therefore, they were dependent on input from the component teams. Moreover, the integration teams' liaison members were not authorized to prescribe the information component teams would gather for display on the COP or to enforce the use of such information for subsequent asset deployments.

**Measures**

Consistent with previous research using the LDS, all constructs in this study were conceptualized as configural unit properties (Kozlowski & Klein, 2000) at the MTS level of analysis.

***Intrapersonal functional diversity.*** We operationalized IFD as the proportion of members in an MTS that had acquired experiences across different functional domains during the first two LDS sessions (see Park et al., 2009, for a similar approach). Specifically, during the first LDS session, individual participants worked in one of the four distinct functions described before and, consequently, gained hands-on experience in the respective domain (i.e., operations [point team], intelligence [support team], and liaison or integrative leadership [integration team]). For the second LDS session, some participants remained within their original function, whereas others switched to a different domain. Notably, due to the screening criteria described before, participants in our sample did not change domains between the second and third sessions. Further, members remained within the same MTS across LDS sessions, such that functional rotations only took place within (not between) the respective systems. We note that the decision to switch members' functional domains was within MTSs' own discretion. Consistent with prior team-level research (e.g., Bunderson & Sutcliffe, 2002; Buyl et al., 2011; Cannella et al., 2008), we capitalized on these naturally occurring role transfers to capture IFD.

Whether or not participants rotated between different domains had important implications for their functional knowledge. The LDS was designed to enable participants to grasp a domain's basic tasks, demands, and constraints within a single session. At the same time, the simulation's dynamism and difficulty made it virtually impossible to develop sophisticated specialized knowledge in a functional domain after one single episode. Different LDS sessions had different target distributions, for example, therefore exposing participants to unique challenges that forced them to rethink and refine their extant knowledge. Hence, participants that remained in the same function for two consecutive sessions could reflect on their actions in the first session, get feedback, and try out different solutions in the second session. These participants were able, therefore, to develop deeper specialized knowledge than participants who switched to a different function after the first session.

These advantages notwithstanding, remaining in a single domain also limited participants' breadth of functional knowledge. Different LDS domains posed distinct challenges and, thus, it was not possible for members to simply apply what they had learned in one function toward other domains. Experience in intelligence (such as finding assets' sweet spots), for example, provided little help with the specific challenges of operations (such as destroying hostile targets while keeping the home base protected). Hence, only participants that switched between functional domains during consecutive LDS sessions had the opportunity to develop broad, generalist functional knowledge.

Overall, 63 percent of our study participants remained in their initial functional domain after the first LDS session, and 37 percent switched to a different domain. Importantly, the number of participants switching functional roles within an MTS differed considerably across the systems in our sample, ranging from zero to 14 (all) members ($M$ = 5.18; $SD$ = 4.59). As such, the degree to which MTSs comprised specialist members with narrow experiences after the second simulation (i.e., experiences in only one functional domain) versus generalist members with broader experiences (i.e., experiences in two functional domains) varied widely. Also, the present measure of IFD was normally distributed (*skewness* = .34, n.s.) and unrelated to past MTS performance ($r$ = .12, n.s.), past horizontal coordination ($r$ = -.08, n.s.), past aspirational behavior ($r$ = -.07, n.s.), and past vertical coordinated action ($r$ = -.01, n.s.). Hence, we can rule out some important third-variable confounds with regard to our key independent variable.

***Horizontal coordination.*** Consistent with Lanaj et al. (2013), we measured horizontal coordination as the number of point team missions based upon intelligence discovered by the support team in the preceding round and captured on the COP.[7] A large number of such missions indicates effective horizontal coordination, such that (a) the support team has accurately anticipated the point teams' needs, has aligned its asset deployments accordingly, and shared the resulting intelligence on the COP, and (b) the point team has understood the respective information's relevance and has acted upon it in a timely manner. Importantly, horizontal coordination does not simply denote component teams' general use of the COP, since the support team could also share intelligence on the COP that was not useful for the point team (and was therefore not used for point team missions), and the point team could also display (and later engage) self-identified targets on the COP.

Besides horizontal coordination between overall component teams (as captured in the present measure; Lanaj et al., 2013), scholars have also discussed dyadic coordination between

[7] Lanaj et al. (2013) reverse coded this horizontal coordination measure to capture component teams' failure to engage in horizontal coordination. In the present manuscript, horizontal coordination is not reverse coded; higher scores, thus, denote greater horizontal coordination.

individual component team members (Davison et al., 2012). We focus on horizontal coordination across the MTS as a whole because such coordination represents synergistic efforts that can facilitate overall system performance (e.g., DeChurch & Marks, 2006; Lanaj et al., 2013; Marrone, 2010). The consequences of individual members' dyadic coordination are less clear; these activities may align with or counteract the actions of other parts of the MTS and, therefore, may have ambiguous performance effects (Davison et al., 2012; see also Klein & Pierce, 2001).

***Aspirational behavior.*** Targets in the LDS differed considerably in value (i.e., points to be gained by engaging a target), and it was imperative that MTSs engaged high-value targets to achieve high overall performance. At the same time, high-value targets were particularly difficult to engage. In particular, participants were informed during the initial briefing that (a) many high-value opportunities were located in the remote half of the task environment and (b) these opportunities were well-protected and mobile. Consequently, success for these missions required simultaneous deployment of multiple specialized RPAs, and members had to deliberately forgo less challenging targets to pursue these opportunities.

We therefore operationalized aspirational behavior as the number of operations missions sent to the remote half of the task environment in pursuit of high-value targets.[8] An MTS exhibited high aspirational behavior when its members frequently pursued remote, valuable targets with complex "packages" of multiple RPAs. In contrast, when a system was low in aspirational behavior, most of its missions involved single RPAs directed at low-value targets

---

[8] Aspirational behavior is conceptually different from risk taking. Clearly, although engagement in high-impact, specialized tasks may pose risks in some circumstances, this is not a defining feature of such aspirational behavior (i.e., there may be high-impact tasks that involve little risk; Lanaj et al., 2013). Correspondingly, in the present sample, aspirational behavior and risk taking (i.e., the number of unescorted deployments to 'blind' areas where assets' safety was unclear) were moderately positively correlated ($r = .37$, $p < .01$).

that did not require refuel (because they were close to the base), escort (because they were unprotected), or tracking (because they were stationary).

***Vertical coordinated action.*** Integration team members with leadership roles (i.e., the mission commander and directors) had authority to review and modify component teams' asset deployment decisions. Following Davison et al. (2012), we operationalized vertical coordinated action as the number of lower-level decisions modified in this process. We reverse-coded this measure, such that higher values represent greater vertical coordinated action.[9]

With high vertical coordinated action, asset deployments were well-aligned and coherent across hierarchical layers in the MTS and, thus, there was no reason to modify component team decisions (Davison et al., 2012). Importantly, given the large number of deployment alternatives in the simulation, it is implausible that integration and component teams would coincidentally agree on a coherent set of decisions. Also, considering that participants were observed for promotion, it is unlikely that integration team leaders would passively and uncritically accept component team decisions.[10] Hence, few higher-level modifications reflect high vertical coordinated action. In case of low vertical coordinated action, on the other hand, asset deployments were misaligned and incompatible across hierarchical layers in the MTS, causing the integration team to veto or change many component team decisions. Hence, many higher-level modifications reflect a relative lack of vertical coordinated action.

---

[9] Multiteam systems controlled 16 RPAs and 32 intelligence assets; consequently, the integration team could modify twice as many support team decisions as point team decisions. To prevent distortion, we therefore standardized modifications within component teams before calculating an average multiteam system score. We note that a validation study by Davison et al. (2012) found this vertical coordinated action measure to positively relate with participants' perceptions of vertical coordination ($r = .43$, $p < .05$; corrected for attenuation).
[10] During observations of the multiteam systems and debriefing sessions, we never encountered behaviors that would suggest lack of engagement or commitment.

We note that the present measure of vertical coordinated action (drawn from Davison et al., 2012) is different from the vertical coordination dimension within Lanaj et al.'s (2013) broader coordination failures construct. Whereas Lanaj et al. (2013) measured only instances in which a lack of vertical coordination affected MTS performance, our measure captures vertical coordinated action without regard to its performance consequences. As such, the current measure appears more appropriate for the present purposes.

***MTS performance.*** An MTS's performance was operationalized as the sum of points gained from successfully engaging targets minus points lost through hostile attacks during the third LDS session. This measure represents a system's collective, overall performance (Davison et al., 2012; Lanaj et al., 2013).

***Control variables.*** To rule out possible biases from differences in training effectiveness and task mastery, we controlled for MTS performance during the LDS session immediately preceding the one reported here (i.e., session 2) when examining performance consequences of horizontal coordination and aspirational behavior.

**Data Analysis**

We used hierarchical linear regressions (at the MTS level of analysis) to test the interactive relationships of IFD and vertical coordinated action with the mediators (horizontal coordination and aspirational behavior) as well as the relationships between these mediators and MTS performance. Further, to examine the full moderated-mediation hypotheses, we used a bootstrap approach to estimate indirect relationships between IFD and MTS performance (mediated by horizontal coordination and aspirational behavior) at higher and lower levels of vertical coordinated action (±1 SD). We interpreted bias-corrected 95-percent confidence intervals to assess the conditional indirect relationships' statistical significance (Edwards & Lambert, 2007). We standardized all predictor variables prior to the analyses.

# RESULTS

## Descriptive Statistics

Table 3.1 depicts means, standard deviations, and bivariate correlations for all variables. As expected, the direct associations of IFD with horizontal coordination ($r$ = .09, n.s.) and aspirational behavior ($r$ = –.03, n.s.) were non-significant, underlining the potential relevance of considering moderating factors for these relationships. Also, previous performance was significantly related with MTS performance in the focal, third LDS session ($r$ = .31, $p$ < .01) and, therefore, was an important covariate (Becker, 2005).

**TABLE 3.1**

**Means, Standard Deviations, and Correlations**

| | | | *r* | | | | |
|---|---|---|---|---|---|---|---|
| Variables | *M* | *SD* | 1 | 2 | 3 | 4 | 5 |
| 1. Past performance | 161.93 | 43.12 | | | | | |
| 2. Intrapersonal functional diversity (IFD) | .37 | .33 | .09 | | | | |
| 3. Vertical coordinated action | .00 | 1.00 | -.07 | .05 | | | |
| 4. Horizontal coordination | 51.50 | 13.20 | .07 | .09 | .20** | | |
| 5. Aspirational behavior | 85.05 | 15.04 | -.08 | -.03 | .07 | .02 | |
| 6. Future performance | 139.25 | 46.80 | .31** | -.04 | .04 | .18* | .11 |

*Note:* $N$ = 236 MTSs.

** $p$ < .01; * $p$ < .05

## Hypotheses Testing

Hypothesis 3.1 predicted that the positive indirect association between IFD and MTS performance (through horizontal coordination) would be stronger when vertical coordinated action was higher, but weaker when vertical coordinated action was lower. To test this hypothesis, we first regressed horizontal coordination on IFD, vertical coordinated action, and the multiplicative term of IFD × vertical coordinated action. As shown in Table 3.2, we found a significant interactive relationship ($B = 1.84$, $SE = .86$, $p < .05$). The association between IFD and horizontal coordination was positive when vertical coordinated action was higher (simple slope at +1 SD = 2.80, $SE = 1.15$, $p < .05$), whereas this relation did not reach significance when vertical coordinated action was lower (simple slope at –1 SD = –0.87, $SE = 1.26$, n.s.). We then examined the performance implications of horizontal coordination. Even when controlling for past performance, IFD, and aspirational behavior, we found a significant positive relationship between horizontal coordination and MTS performance ($B = 7.50$, $SE = 2.87$, $p < .01$; see Table 3.3).

**TABLE 3.2**

**IFD, Horizontal Coordination, and Aspirational Behavior**

| | Horizontal coordination | | Aspirational behavior | |
|---|---|---|---|---|
| | Step 1 | Step 2 | Step 1 | Step 2 |
| Intrapersonal functional diversity (IFD) | 1.29 (.85) | .96 (.84) | -.52 (.98) | -.76 (.98) |
| Vertical coordinated action (VC) | 2.54 (.85)** | 2.65 (.84)** | 1.03 (.98) | 1.19 (.97) |
| IFD × VC | | 1.84 (.86)* | | 2.57 (1.00)* |
| R-square (adjusted) | .038** | .052** | .000 | .021* |
| R-square change | | .014* | | .021** |

*Note:* $N = 236$ MTSs

Unstandardized regression coefficients are shown; standard errors are noted within parentheses.

** $p < .01$; * $p < .05$

In the final step of examining Hypothesis 3.1, we considered the conditional indirect relationship between IFD and MTS performance, as mediated by horizontal coordination, at different values of vertical coordinated action. This indirect relationship was positive at higher levels of vertical coordinated action (indirect relationship at +1 SD = 20.11; 95% bootstrap CI = 3.90 to 55.22). The indirect relationship was non-significant, however, when vertical coordinated action was lower (indirect relationship at –1 SD = –6.55; 95% bootstrap CI = –34.49 to 9.91). Thus, Hypothesis 3.1 was supported.

**TABLE 3.3**

**Horizontal Coordination, Aspirational Behavior, and MTS Performance**

| | MTS performance | |
|---|---|---|
| | Step 1 | Step 2 |
| Past performance | 14.81 (2.92)** | 14.85 (2.88)** |
| Intrapersonal functional diversity (IFD) | -3.08 (2.92) | -3.61 (2.87) |
| Horizontal coordination | | 7.50 (2.87)** |
| Aspirational behavior | | 5.90 (2.86)* |
| R-square (adjusted) | .093** | .128** |
| R-square change | | .035** |

*Note:* $N$ = 236 MTSs
Unstandardized regression coefficients are shown; standard errors are noted within parentheses.
** $p < .01$; * $p < .05$

Hypothesis 3.2 predicted that the indirect, negative relationship between IFD and MTS performance, through reduced aspirational behavior, would be more pronounced when vertical coordinated action was lower rather than higher. We found a significant interactive relationship between IFD, vertical coordinated action, and aspirational behavior ($B$ = 2.57, $SE$ = 1.00, $p < .05$; see Table 3.2). The association between IFD and aspirational behavior was negative when vertical coordinated action was lower (simple slope at –1 SD = –3.32, $SE$ = 1.46, $p < .05$) but non-significant when vertical coordinated action was higher (simple slope at +1 SD = 1.81, *SE* = 1.33, n.s.). As shown in Table 3.3, aspirational behavior was, in turn, positively related to MTS performance, even after considering past performance, IFD, and horizontal coordination ($B$ = 5.90, $SE$ = 2.86, $p < .05$).

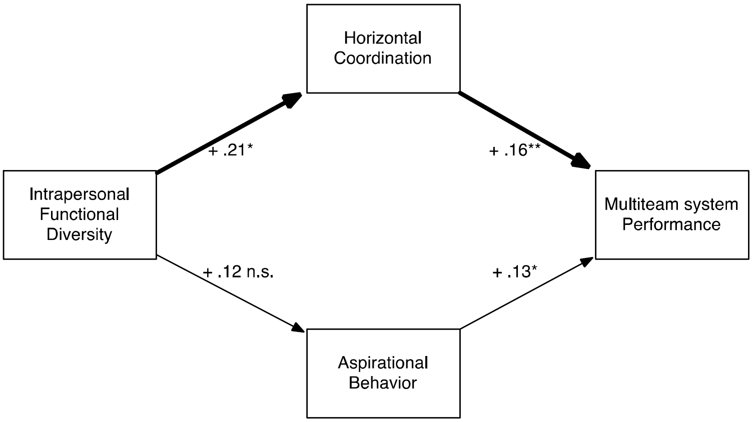
Tests of the overall conditional indirect association showed a negative indirect relationship between IFD and MTS performance, through aspirational behavior, under conditions of lower vertical coordinated action (indirect relationship at –1 SD = –19.59; 95% bootstrap confidence interval = –59.20 to –1.25). This indirect relationship did not reach significance, however, when vertical coordinated action was higher (indirect relationship at +1 SD = 10.68; 95% bootstrap confidence interval = –3.24 to 37.98). Thus, Hypothesis 3.2 was supported.

Figure 3.2 illustrates the results for the conditional indirect relationships proposed in Hypotheses 3.1 and 3.2.[11] As shown in the top half, high vertical coordinated action augmented IFD's *positive* performance implications (through horizontal coordination) and attenuated its *negative* consequences (through aspirational behavior). In contrast, the bottom half of the figure shows that low vertical coordinated action augmented IFD's *negative* performance implications (through aspirational behavior) while attenuating its *positive* consequences (through horizontal coordination).

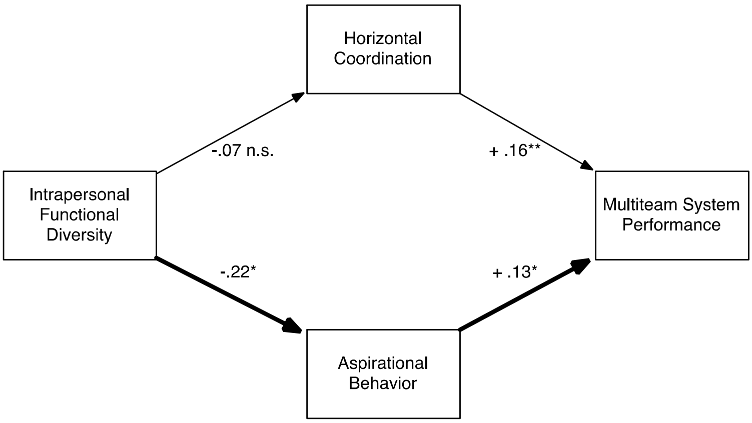
[11] The interactive relationship between IFD, vertical coordinated action, and horizontal coordination remained almost identical when controlling for prior horizontal coordination ($B$ = 1.58, $SE$ = .82, $p$ = .05). Similarly, the interactive relationship between IFD, vertical coordinated action, and aspirational behavior remained almost identical when controlling for prior aspirational behavior ($B$ = 1.96, $SE$ = .95, $p < .05$). Finally, all findings for aspirational behavior remained robust when controlling for risk taking.

**FIGURE 3.2**

**Conditional Indirect Effect of IFD at Higher Levels of Vertical Coordinated Action (+1.0 SD)**




**Conditional Indirect Effect of IFD at Lower Levels of Vertical Coordinated Action (– 1.0 SD)**




*Note:* Standardized regression coefficients are shown; significant indirect paths are indicated with thick arrows.

** $p < .01$; * $p < .05$

We employed binomial effect size displays to assess our results' practical significance (Rosenthal & Rubin, 1982). Specifically, we examined the implications of the 'best-case scenario' advanced in this research (i.e., high IFD combined with high vertical coordinated action) for MTSs' performance. In our sample of 236 MTSs, 6.4 percent (i.e., 15 systems) had both IFD and vertical coordinated action scores at one standard deviation or more above the mean. These MTSs were clearly overrepresented among the top-performing systems, with 16 percent of the top-25 performers exhibiting a best-case scenario. In fact, MTSs with high IFD *and* high vertical coordinated action were 2.5 times more likely to be in the top 25 than systems with lower IFD and/or vertical coordinated action. Moreover, MTSs exhibiting a 'best-case scenario' were underrepresented among the worst performing systems in our sample, representing only 4 percent of the bottom-25 performers. Thus, MTSs with high IFD and high vertical coordinated action were 1.6 times *less* likely than others to experience mission failure. These findings indicate that our results are not only statistically significant but also have tangible relevance from a practical perspective.

## DISCUSSION

In recent years, MTSs have increasingly been used to accomplish a wide array of complex tasks, ranging from large-scale research and development projects to military operations and disaster relief (Goodwin et al., 2012; Hoegl et al., 2004). Although such systems have the potential to flexibly and effectively cope with challenges beyond the means of other organizational forms, research has demonstrated that they cannot live up to their promise in many cases and often fail to exploit their full potential (DeChurch & Mathieu, 2009; Donahue & Tuohy, 2006). The present study takes important steps to address this issue. It is among the first to investigate IFD as a key predictor of MTS performance. In doing so, it extends previous research on the role of IFD in stand-alone teams and larger organizations where results have been contradictory, and it presents a unified model that reconciles these past discrepant findings within an MTS context.

These results can advance the way scholars think about the role of IFD and, more generally, about MTS management. Specifically, our findings indicate that neither the positive relationships between IFD and performance reported in research on stand-alone teams (e.g., Bunderson & Sutcliffe, 2002; Park et al., 2009) nor the negative performance implications of IFD reported in research on larger organizations (e.g., Buyl et al., 2011; Postrel, 2002) generalize toward MTSs in a straightforward manner. Rather, IFD appears as a double-edged sword in this context. On the one hand, we found evidence for a potentially beneficial role, in that IFD can promote MTSs' horizontal coordination. On the other hand, our findings also point towards potential downsides, with IFD discouraging systems' aspirational behavior. As such, the performance implications of IFD in MTSs are more complex than previous research would suggest. It appears that members with broad functional experience offer great potential for such systems but, at the same time, pose unique managerial challenges.

Our results further indicate that both the positive and the negative performance consequences of IFD are contingent on a single, common boundary condition. Namely, vertical coordinated action plays a crucial moderating role, enabling an MTS to reap IFD's benefits while mitigating associated drawbacks. Although MTSs are prototypically less hierarchical than traditional organizations (Davison et al., 2012; Mathieu et al., 2001), these results show that vertical coordinated action by a central integration team tasked with leadership responsibility is a key success factor even in this organizational form.

These findings contribute to research on MTSs and collaborative team structures by advancing both micro-level OB and macro-level OT perspectives on such arrangements' effectiveness and, most importantly, by illustrating how these distinct perspectives can be fruitfully integrated. Research following an OB approach, on the one hand, has emphasized IFD's role for effective coordination and task accomplishment (Ford & Schmidt, 2000; Joshi et al., 2009). Typically, however, this literature has examined IFD within stand-alone teams (Bunderson & Sutcliffe, 2002; Park et al., 2009; Rulke & Galaskiewicz, 2000) and, consequentially, has neglected the larger organizational context in which teams' bottom-up potentials for coordination may unfold. Even to the extent these studies have examined strategies for promoting IFD (e.g., personnel transfer, cross-functional job rotation) alongside contextual, top-down integration mechanisms (e.g., reward schemes, collocation; Leenders & Wierenga, 2002; Maltz & Kohli, 2000), this research has considered such mechanisms as an alternative (rather than a supplement) to IFD. The present manuscript addresses this issue by illustrating that IFD's effects may critically depend on formal integration teams' efforts, thus advancing OB-based theories of MTS functioning by embedding component teams' emergent potentials for horizontal coordination within their larger context.

MTS research originating from an OT tradition, on the other hand, has frequently discussed integration teams' importance for enabling horizontal coordination in differentiated team structures (Browning, 1998; Davison et al., 2012). Empirical studies on this issue have concluded, however, that integration teams' effectiveness often remains "questionable," emphasizing the need to more closely examine determinants of such effectiveness (Lawrence & Lorsch, 1967: 13; see also Dewsnap & Jobber, 2009). Addressing this ambiguity, our findings illustrate that an integration team's mere presence (i.e., a purely structural solution) may not be sufficient; an integration team's benefits for horizontal coordination, aspirational behavior, and MTS performance hinge on the degree to which this team actively aligns its activities with component teams (i.e., vertical coordinated action). In addition, our study shows that to fully understand vertical coordinated action's role, one needs to consider this top-down integration mechanism in conjunction with an MTS's bottom-up potentials for coordinated task-achievement (as derived from IFD). To effectively resolve MTSs' performance challenges, integration teams need to actively support component teams in utilizing their capacities for horizontal coordination, while preventing the negative side-effects such capacities may entail (e.g., reduced aspirational behavior).

Finally, these findings may advance insights on the functioning of MTSs. MTS scholars have typically considered top-down guidance and bottom-up emergence of horizontal coordination as alternative, mutually exclusive strategies towards realizing collective efforts. Both Davison et al. (2012) and Lanaj et al. (2013), for example, suggest that it is more effective to rely on integration teams, rather than component teams, for managing critical coordination processes. This may, however, have oversimplified the complex reality within dynamic multiteam settings (Lewis, 2000), where integrative leaders and lower-level members need to combine top-down support and bottom-up efforts to effectively coordinate work. By integrating OB and OT insights, the present research shows how central integration teams and decentralized component teams can mutually support coordination in a complementary way, thereby promoting MTS success. As such, this study advances a new approach for MTS theory that capitalizes on component teams' distinct capacities *as well as* formal integrative leaders' efforts.

**Limitations**

The research presented here has several strengths, including a large sample of MTSs observed in a rigorously controlled setting with a high degree of psychological realism (Berkowitz & Donnerstein, 1982). Still, some limitations should be taken into consideration when interpreting our findings. As noted before, ethical and practical reasons precluded us from manipulating IFD and randomly assign MTSs to distinct conditions. Given that our model is in line with previous theoretical work that has identified IFD as a potential antecedent of MTSs' coordination and performance (e.g., Ford & Schmidt, 2000), we have some confidence in the predicted causal directions. Moreover, the natural emergence of IFD in the present study's MTSs appears consistent with IFD's development in many 'traditional' organizations, where members typically can exert a certain degree of influence over their own functional development (e.g., by taking on a different job; Higgins, 2001; Vardi, 1980). Nonetheless, we recognize a need for more evidence based on experimental designs with random assignment before causal inference is justified.

Moreover, some real-life MTSs may have more members and sub-teams than the systems studied here (Goodwin et al., 2012). At the same time, MTSs represent an intermediate organizational form, located between large organizations or collaboration networks and stand-alone teams. Thus, MTSs comprising as few as two or three teams are not uncommon, as reflected in the definition of this type of organization (i.e., "two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals"; Mathieu et al., 2001: 290). In addition, the number and size of MTSs studied here compares favorably with prior experimental research (for a review, see Davison & Hollenbeck, 2012).

With regard to our IFD measure, one might argue that the fact that participants could only change functional domains between the first and second simulation sessions limited their opportunity to develop broad functional experiences. In real-life organizations, individuals may vary more widely in this regard (e.g., de Vries et al., 2014). This concern is somewhat mitigated, however, by the fact that IFD reflects a collective property at the MTS level. As a result, there was sufficient variation in IFD between MTSs to meaningfully test the proposed relationships. Relatedly, there may be real-life instances in which low (high) IFD does not translate into deep (broad) functional knowledge to the same degree as in the present study (e.g., repetitive, routine tasks). However, as MTSs typically deal with complex and uncertain issues (Mathieu et al., 2001), we believe such situations will be relatively uncommon in this context.

Further, although our computerized decision-making simulation enabled hypotheses testing in a relatively controlled setting, it came at the cost of reduced generalizability. We tried to mitigate this concern by using actual employees (i.e., Air Force officers) for whom MTS performance affected career advancement. Also, the simulation was a realistic exercise that closely resembled participants' regular work. Moreover, although this study did not follow MTSs for years, it was not a short-term laboratory investigation of strangers that cooperated for just a few hours. MTSs worked together for five consecutive weeks on different tasks (including the LDS). Nevertheless, generalization of our findings to longer-term, non-military contexts is an open question that can only be addressed through constructive replication in diverse field settings.

Another potential source of concern may relate to our use of behavioral measures. This measurement approach fit the present manuscript's focus on IFD's direct, behavioral outcomes and helped us to overcome key weakness associated with more subjective, survey-based instruments (e.g., recall and response bias, social desirability; Schwarz, 1999). On the other hand, this approach prevented us from capturing fine-grained mechanisms and micro-processes through which IFD may translate into horizontal coordination and aspirational behavior (cf. De Vries et al., 2014; Lanaj et al., 2013). Additional research employing alternative (e.g., survey-based) instruments is needed to explore such detailed micro-mediation processes.

Finally, this study's relatively small effect sizes may lead to concerns about our results' practical significance – although we believe the binomial effect size displays presented before alleviate such reservations to some extent. In addition, Prentice and Miller (1992: 160-161) argued that even small effect sizes (in statistical terms) may be "impressive" when they show that “a minimal manipulation of the independent variable still accounts for some variance in the dependent variable.” In the present case, we note that a relatively small development of IFD within a limited range of functional domains over a limited time frame was sufficient to shape key processes relevant for MTS performance. Thus, our findings reveal IFD’s distinct potential (in combination with vertical coordinated action) to influence MTSs’ functioning.

**Future Research**

Beyond addressing limitations, future research could extend our conceptual model in several important ways. For example, such research could broaden the current manuscript’s focus on IFD’s behavioral consequences by investigating antecedent conditions that lead to the development of IFD. Scholars could examine, for example, if IFD is more effective when members choose to switch functional domains to broaden their functional knowledge rather than being forced to rotate because they performed poorly in their original function (see Tesluk & Jacobs, 1998).

Subsequent research could also explore task and contextual characteristics as alternative contingency factors for the relationship between IFD and MTS performance. IFD’s positive consequences (through horizontal coordination), for example, may intensify with high inter-team task interdependence, because MTSs may then place stronger demands on members’ capacities for aligning activities across specialized component teams (Joshi et al., 2009). Highly uncertain and complex environments, on the other hand, may place a premium on functionally narrow members with deep knowledge for substantive, high-impact tasks, rather than functionally broad members with more superficial perspectives. Hence, IFD’s negative performance implications (through reduced aspirational behavior) may be particularly salient in such environments. Additional research could build on these notions to further complete our understanding of IFD’s role in multiteam settings.

In addition, it may be interesting to extend our conceptual model by investigating antecedents of vertical coordinated action. Clearly, integration teams in the present study differed markedly in the extent to which they engaged in this type of behavior. Some of these teams, for example, proactively communicated their system-wide insights toward component teams (an example of high vertical coordinated action), whereas others withdrew themselves from component teams to a greater extent and enforced their own, independent perspectives on task completion within the MTS (an example of low vertical coordinated action; see also Davison et al., 2012). Such differences may, for example, stem from variability in integration teams' task and goal orientations (Lawrence & Lorsch, 1967) or integration team members' dominance and assertiveness (Haleblian & Finkelstein, 1993). Empirically examining these ideas may advance our understanding of the micro-foundations of vertical coordinated action as a key aspect of MTS effectiveness.

**Practical Implications**

The challenge of effectively coordinating multiple specialized teams involved in critical joint tasks has long troubled management practice (Mathieu et al., 2001; Smith et al., 1995). The present study addresses this problem and, as such, has important implications for the management of MTSs (as well as traditional organizations designed according to MTS principles; Millikin et al., 2010). Based on our results, for example, it appears possible to improve horizontal coordination and multiteam system performance by selecting members with broad functional experiences or by providing training opportunities and assignments that promote such experiences. Importantly, several of-the-shelf solutions are available for promoting IFD, including job rotation and personnel transfer schemes (Griffin & Hauser, 1996; Leenders & Wierenga, 2002), career development trajectories (Raskas & Hambrick, 1992), and cross-training strategies (Cannon-Bowers et al., 1998; Marks et al., 2002). By increasing IFD, MTS leaders may enable component teams to bridge language, thought-world, and goal differences that may otherwise prove detrimental.

By itself, however, selecting and/or training functionally broad members is unlikely to guarantee MTS performance. Our results suggest that without effective integration team support (through vertical coordinated action), horizontal coordination may be too complex and burdensome even for MTSs with high IFD. In fact, IFD may even diminish MTS performance in such situations by lowering a system's aspirational behavior. Again, MTS leaders may rely on well-developed interventions to promote vertical coordinated action, thus realizing IFD's potentials and circumventing its downsides. "Frame-of-reference" trainings, for example, may provide component and integration teams with a standardized language that enables efficient coordination across an MTS's hierarchical layers (Firth et al., 2014: 9). Similarly, "strategizing" training (i.e., training integrative leaders to organize and evaluate information regarding component teams' contribution to the overall system's strategic goal) or "coordinating" interventions (i.e., training integrative leaders to communicate information to component teams about necessary alignments with other teams) may improve integration teams' capacity for vertical coordinated action (DeChurch & Marks, 2006: 312). By combining high IFD with effective vertical coordination, MTSs may be able to live up to their full potential and succeed in meeting the challenges of the environments in which they operate.

Finally, limits associated with time and training budgets imply there will be trade-offs associated with developing IFD, and the present study informs organizational leaders' decision-making in this regard. If an MTS is vertically well-coordinated, in particular, substantial performance advantages may be realized by developing members' IFD. In contrast, if a system is lacking effective vertical coordination, increasing IFD may entail considerable performance risks.

Management could, then, prioritize the development of vertical coordinated action, before devoting resources to strengthening IFD.